Physics 133.01 – Physics II: Electricity, Magnetism, and Waves - Fall 2019
MWF 8:00 - 8:50 AM - Hugel Science Center Room 100
Professor Christopher Hawley
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Lab: 021 HSC
Office Hours: Mon. 1:00-3:00 PM, Tues. 10:00 AM -12:00 PM
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Required Primary Text:

- Young and Freedman, University Physics with Modern Physics, 14th Ed., with MasteringPhysics. If you did not purchase MasteringPhysics with the text, you can buy it online at http://www.MasteringPhysics.com/.
- Physics 133 Laboratory Manual

Course Website:

We will use Moodle – http://moodle.lafayette.edu. "**PHYS 133.01-Fall 2019 Phys II:Elect, Magnet & Waves**" should be in your list of current courses. Handouts, homework assignments/solutions, supplemental articles, etc., can be downloaded from this site.

Course Overview:

This course is a calculus-based introduction to the foundations of electricity and magnetism, intended for students majoring in science or engineering. Our emphasis will be on identifying, understanding, and applying the fundamental principles of electric fields and potentials, basic circuits, magnetic fields, and electromagnetic waves.

Student Learning Outcomes: After completing this course, a student should be able to

- understand that the goal of physics is to comprehend phenomena in the physical world;
- to demonstrate the ability to formulate a testable hypothesis based upon acquired physical data;
- collect and analyze experimental data relevant to testing a hypothesis;
- evaluate whether the evidence supports, refutes, or leads to the revision of the hypothesis;
- to create, interpret, and critically evaluate graphs, tables and models of physical data;
- understand scientific uncertainty and how it is reduced with additional data acquisition and hypothesis testing;
- distinguish between scientifically testable ideas and opinion.
- understand, identify, and apply the fundamental principles of physics in a variety of physical situations;
- use both qualitative reasoning and quantitative problem-solving skills in applying those principles;
- apply Maxwell's equations and the principles of waves to appropriate physical situations; and

- to engage in the process of doing physics, including such tasks as developing and testing models, interpreting experimental data, solving problems, and communicating results.

Co/Prerequisites:

You must have credit for Phys 131 or 151; Math 162 or permission from instructor

In Case of Inclement Weather:

I will leave a message on moodle announcements which will push an email to the class.

Grading:

Your grade will be based on:

Homework:	25% total
Labs:	20% total
Hour exams:	35% total (11.67% each)
Final exam:	20%

All grading mistakes have to be resolved within one week after the homeworks or examinations are returned to the students. Please do not wait to contact me if there is an issue!

Your Responsibilities:

A good rule of thumb is that you should spend approximately two hours outside of class for each hour in class for any college course. This means that you should allow an average of six hours per week studying for physics.

Attendance: Regular class attendance is expected. Too often, erratic attendance and poor performance seem to go together. You are responsible for all material discussed in class along with the reading assigned on the syllabus. Class participation will be considered in your final grade if warranted.

Reading: Your text is a critical resource for this class - it is our source of definitions, facts, ideas, explanations, derivations and worked examples. It is crucial that you read the assigned material before the relevant lecture so that the material is not completely unfamiliar to you. Class time will be used to review and discuss those ideas, answer questions, observe demonstrations, work additional examples, and practice applying those ideas to various physical situations. See the lecture schedule for the assigned readings each day.

Ask questions: If you are confused, it is important that you stop me and try to sort it out rather than fall behind. Please interrupt my lecture whenever anything isn't clear. Remember that if you are confused, there are almost certainly many others in the class who are confused as well, and they would welcome your question.

Homework Problems: A full understanding of how to apply the mathematical formalisms comes only with much practice. Therefore homework problems are a crucial, probably the most crucial, part of this course. Homework will be assigned on a weekly basis and will generally be due on Wednesdays, turned in to me at the start of class (**8 AM**). **Late assignments are**

generally not accepted, unless you have received an exemption from me **ahead of time**. Please plan to manage your time accordingly.

Weekly problem sets will generally consist of a combination of online and written problems. Online problems will be through Mastering Physics. For at least one of the written problems each week, you will be required to work as a group. I will assign groups of ~ 4 students and the groups will rotate every 3 weeks or so. For your group problem, each member must write up the solution individually and must include the names of the other group members on the write up. I encourage you to work with your group on the rest of the problems in the assignment as well! The purpose of these group problems is to introduce you to more challenging and interesting concepts and to give you additional practice developing problem-solving skills and insight into the physics we are studying. Working with a variety of others will help inform your problem-solving by bringing potentially disparate approaches/opinions to the table, forcing you to discuss and debate with one another as you work towards a common solution.

Laboratory: The laboratory is an essential part of the course. There you will see and experiment with many of the concepts we cover in class and learn how to approach, analyze, and communicate details of an experiment. **You must complete all of the assigned experiments.** Details will be provided by your laboratory instructor.

Exams: There will be three in-class exams as indicated on the syllabus. An equation sheet will be provided by me for each exam. A copy will be provided to you in advance so that you can familiarize yourself with it.

The idea is that you will use your study time to focus on the fundamental ideas and to practice solving problems rather than to memorize complicated formulae. However, you will do best if you know the material well enough to have in mind the formula you need before you look for it on the equation sheet; use the sheet just to remember where the factors of 2 and π belong. The goal of the course is to understand and be able to use the basic physics principles, rather than to memorize how to solve specific types of problems. Accordingly, exam problems will not be identical to any particular homework problems, but they will be based on the same principles and can be solved using similar strategies. Practice on the homework problems will be essential in developing the skills and solid understanding of the principles needed to do well on the exams.

To reinforce this emphasis on understanding, the tests may include short answer questions that stress the underlying principles, somewhat similar in spirit to the questions at the end of each chapter.

There will be a comprehensive final exam at a time to be arranged by the registrar. Please do not make travel plans that may conflict with the final exam unless they are absolutely unavoidable. Please bring any conflicts with the time of the final exam to my attention as soon as possible.

The final exam will be the same for all sections. The best strategy for preparing for the final exam is to keep up with the course day-by-day and to be sure that you understand every homework problem thoroughly when you hand it in.

Guidelines for Writing Up Homework:

It is to your advantage to do the assigned homework. I have chosen the problems to help you learn the material. Physics can be a complicated thing, but repeatedly working with it (and at it) is essential in order to gain physical intuition and get comfortable with the mathematical theory.

Feel free to use computational aids for some of the mathematics if you prefer, but note that there is some advantage to working things out by hand. Not being able to solve problems "by inspection" could end up hurting you on an exam where you may not be permitted to use computational tools and, frequently, there are mathematical tricks you can use to easily simplify a problem that you will not appreciate if you ask a program to do the work.

I encourage you to work on these problem sets collaboratively, though I do expect you to take 10-15 minutes to give a problem "the old college try" on your own so you enter into discussion with others having some ideas to contribute. You will make your life easier as well as improve your understanding if you work with others (either by explaining it or having it explained to you). I expect solutions to be written up individually (or, if your handwriting is illegible, typed), and all collaboration should be properly acknowledged.

I expect your problem sets to be clearly and logically organized. This means that:

- Each problem should start **on a new page**.
- Write out the problem (or an abbreviated version containing all relevant information). Draw a picture/diagram if useful.
- Clearly work out the problem, commenting your work as you go. Problem sets should never contain just the math; use words to describe what you are doing and to reference where in the text an equation came from and why it is relevant.
- Remember to keep track of units (by writing them out with all your calculations)! Do the units work out as you expect they ought to at the end of a problem? Dimensional analysis is the easiest check to ensure you have tackled the problem correctly.
- Box your final solutions or major milestones as you do the problem. This makes it easier to grade and also for you to follow your own work when you look it over.
- Comment on the significance of your answer. (Does it make sense? Is it what you expected? Why or why not?)
- Attach a cover page to your problem set. This can be the problem sheet or something else, but it should have your name and a clear acknowledgement of all those you have collaborated with on the assignment. This includes fellow students, faculty, SIs, etc. (anyone who you consulted or worked with).
- Please see me if you have any questions about this! I know it seems a bit ridiculous listed out like this, but I promise that it will serve you well in the long run. Writing in science is different from the traditional humanities paper, but the point is the same: to clearly and effectively communicate something. This will help you to accomplish that.

Collaboration: Collaboration among students on homework is not only allowed, it is very much encouraged! However, any work you turn in must be written by you, in your own words, and faithfully represent your understanding of the course material. Collaboration on exam questions is **never** permitted. Directly copying homework solutions or exam answers will result in a zero for the assignment or exam to failure for the course, depending on the severity and subject of the academic violation.

Course Outline: note the chapter and sections associated with lecture

	Monday	Wednesday	Friday
Week 1 – Aug 26	Coulomb's Law 21:1-3	Electric Fields 21:4-5	Continuous Charge Distributions 21:6-7
Week 2 – Sept 2	Electric Flux 22:1-2	Gauss' Law 22:3 **PS1 Due**	Applications of Gauss' Law (**Worksheet**) 22:4-5
Week 3 – Sept 9	Electrostatic Potential Energy 23:1-2	Electric Potential 23:3 **PS2 Due**	Equipotential Surfaces 23:4-5
Week 4 – Sept 16	Capacitance 24:1-2	Electric Field Energy 24:3-5 **PS3 Due**	**Exam 1 (in class)**
Week 5 – Sept 23	Electric Current 25:1-2	Ohm's Law 25:3-4 **PS4 Due**	Energy and Power in Circuits 25:5-6
Week 6 – Sept 30	Kirchoff's Rules 26:1-2	RC Circuits 26:4 **PS5 Due**	Magnetic Fields 27:1-3
Week 7 – Oct 7	Magnetic Forces on Charges 27:4-5	Magnetic Forces on Currents 27:6-8 **PS6 Due**	Biot-Savart Law 28:1-4
Week 8 – Oct 14	**Fall Break**	Ampere's Law 29:1-4 **PS7 Due**	Applications 28:7
Week 9 – Oct 21	Faradays' Law 29:1-4	Induction 29:5-7 **PS8 Due**	**Exam 2 (in class)**
Week 10 – Oct 28	Inductance and Magnetic Field Energy 30:1-3	RL and LC Circuits 30:4-6 **PS9 Due**	Mechanical Waves 15:1-5
Week 11 – Nov 4	Superposition 15:6-8	Sound Waves 16:1-4 **PS10 Due**	Resonance 16:5-7
Week 12 – Nov 11	Electromagnetic Waves 32:1-3	Energy and Momentum in EM Waves 32:4-5 **PS11 Due**	Reflection and Refraction 33:1-3
Week 13 – Nov 18	Polarization and Scattering 33:4-7	Interference 35:1-2 **PS12 Due**	Thin Film Interference 35:4
Week 14 – Nov 25	**Exam 3 (in class)**	**Thanksgiving**	**Thanksgiving**
Week 15 – Dec 2	Diffraction 36:1-4	Diffraction Gratings and Circular Apertures 36:5-7 **PS13 Due**	Final Review

Final Exam (Comprehensive Test) Time TBD by Registrar

Additional Resources:

There are a variety of resources available to help you in your study of physics. These include my office hours, tutoring through HUB (formerly ATTIC), and working with classmates, and SI sessions.

I encourage all of you to seek help when needed. Generally, the earlier you come the better the results. Interacting with students has been and remains a source of great satisfaction for me – please stop by!

Accommodations:

In accordance with Lafayette College policy, reasonable academic accommodation and support services are available to students who have a documented disability. It is your responsibility to provide me with the appropriate paperwork from the Accessibility Services Office. More information is available at https://hub.lafayette.edu/disability-services/.

Gender Inclusion:

This is a gender-inclusive classroom. I have been provided with a class roster and your legal names. I will gladly honor any requests to be addressed by a different name or pronoun than appears on the class. Please make me aware of any preferences.

Moodle Privacy Statement:

Please note that Moodle contains student information that is protected by the Family Educational Right to Privacy Act (FERPA). Disclosure to unauthorized parties violates federal privacy laws. Courses using Moodle will make student information visible to other students in this class. Please remember that this information is protected by these federal privacy laws and must not be shared with anyone outside the class. Questions can be referred to the Registrar's Office.

Federal Credit Hour Compliance Statement:

The student work in this course is in full compliance with the federal definition of a four credit hour course. Please see the Registrar's Office web site (https://registrar.lafayette.edu/wp-content/uploads/sites/193/2013/04/Federal-Credit-Hour-Policy-Web-Statement.doc) for the full policy and practice statement.